WE CLAIM

Sub A1

1. A computerized system for customizing the operational program for a slave object on a slave machine, comprising:

a master segmentator operable to group the action sites of a master object on a master machine into segments and store the reference data related to said segments in a master file;

a slave regenerator, coupled to said master file, operable to regenerate said master reference data so that variable characteristics of said slave machine are defined and adaptively compensated; and

a slave corrector, coupled to said slave regenerator, operable to correct said operational program for said slave object on said adaptively adaptively compensated slave machine.

2. A computerized system for customizing the operational program in a slave machine prepared to work on action sites of a slave object, said program intended to compensate variable characteristics of said slave machine, comprising:

a first input data generator, associated with a master machine, operable to collect data from a master object which is related in geometry or history to said slave object, comprising geometrical information of action sites and action segments, images of said segments, and geometrical information of said images;

an analysis generator, associated with said master machine and coupled to said first input data

generator, operable to construct relationships for said master machine between said action site locations, action segments, and segment image locations;

a master file, coupled to said analysis generator, operable to store said relationships, said geometrical information and said images as an operational master program;

a second input data generator, associated with said slave machine, operable to generate images of a plurality of action segments of said slave object, defining the variable characteristics of said slave machine;

a segment comparator, associated with said slave machine and coupled to said master file and said second input data generator, operable to retrieve said action segment images from said master operational program as well as from said second input data generator, to compare and quantify said variable machine characteristics, and to relocate said action segments;

an action location corrector, associated with said slave machine and coupled to said segment comparator, operable to retrieve said relocated action segments and to re-compute said action locations in each of said segments;

a third input data generator, associated with said slave machine and coupled to said master file, operable to generate images of alignment references on an object selected first from said slave objects;

a relationship generator, associated with said slave

machine and coupled to said action location corrector and said third input data generator, operable to construct relationships for said slave machine between said re-computed action locations, said alignment reference images and said reference image locations;

a fourth input data generator, associated with said slave machine, operable to generate images of alignment references on an object selected consecutively from said slave objects; and

an operational program corrector associated with said slave machine, coupled to said relationship generator and said fourth input data generator, operable to compare said alignment reference images from said third and fourth input data generators, to combine the result with said relationships, to re-compute said action site locations, and to correct said operational program of said slave machine for working on action sites of said consecutively selected slave object.

3. A computerized system for customizing the bond program for a slave circuit on a slave bonder, comprising:

a master segmentator operable to group the bond pads of a master circuit on a master bonder into segments and store the reference data related to said segments in a master file;

a slave regenerator, coupled to said master file, operable to regenerate said master reference data so that variable characteristics of said slave bonder are defined and adaptively compensated; and

a slave corrector, coupled to said slave regenerator, operable to correct said bond program for said slave circuit on said adaptively compensated slave bonder.

4. A computerized system for customizing the bond program in a slave bonder prepared to attach connecting bonds onto bond pads of a slave integrated circuit, said program intended to compensate variable characteristics of said slave bonder, comprising:

a first input data generator, associated with a master bonder, operable to collect data from a master integrated circuit which is related in geometry to said slave integrated circuit, comprising geometrical information of bond pads and bond segments, images of said segments, and geometrical information of said images;

an analysis generator, associated with said master bonder and coupled to said first input data generator, operable to construct relationships for said master bonder between said bond pad locations, bond segments, and segment image locations;

a master file, coupled to said analysis generator, operable to store said relationships, said geometrical information and said images as a master bond program;

a second input data generator, associated with said slave bonder, operable to generate images of a plurality of bond segments of said slave circuit, defining the variable characteristics of said slave bonder;

a segment comparator, associated with said slave

bonder and coupled to said master file and said second input data generator, operable to retrieve said bond segment images from said master bond program as well as from said second input data generator, to compare and quantify said variable bonder characteristics, and to relocate said bond segments;

a bond location corrector, associated with said slave bonder and coupled to said segment comparator, operable to retrieve said relocated bond segments and to re-compute said bond locations in each of said segments;

a third input data generator, associated with said slave bonder and coupled to said master file, operable to generate images of alignment references on a circuit selected first from said slave circuits;

a relationship generator, associated with said slave bonder and coupled to said bond location corrector and said third input data generator, operable to construct relationships for said slave bonder between said re-computed bond locations, said alignment reference images and said reference image locations;

a fourth input data generator, associated with said slave bonder, operable to generate images of alignment references on a circuit selected consecutively from said slave circuits; and

a bond program corrector associated with said slave bonder, coupled to said relationship generator and said fourth input data generator, operable to compare said alignment reference images from said

third and fourth input data generators, to combine the result with said relationships, to re-compute said bond pad x-y locations, and to correct said bond program of said slave bonder for attaching bonds onto said bond pads of said consecutively selected slave circuit.

5. The system according to Claim 4 wherein said first input data generator comprises:

a first organizer operable to select bond pad points, to collect the x-y locations correlated to said points, and to store the x-y locations data in a reference x-y file;

a segmentator, coupled to said first organizer, operable to group said bond pads into segments, to determine which bond points belong to which of said segments, and to store said segments data in a bond pad segments file;

a second organizer, coupled to said segmentator, operable to select x-y locations and geometrical information identifying segment images, and to store said image x-y locations data in a segment image x-y locations file; and

a collector, coupled to said second organizer, operable to collect images of said segments and to store said images in a segment image file.

6. The system according to Claim 5 wherein said input data are collected manually by an expert.

7. The system according to Claim 5 wherein said input data are collected automatically.

8. The system according to Claim 4 wherein said bond program comprises bonding parameters for integrated circuit chip assembly.

9. The system according to Claim 4 wherein said images are created by illumination, optics, and photographic cameras coupled to said computer-controlled bonders.

10. The system according to Claim 4 wherein said master bonder is a computer-controlled independent bonder having well-understood characteristics.

11. The system according to Claim 4 wherein said slave bonder is any computer-controlled bonder.

12. The system according to Claim 4 wherein said master integrated circuit is an integrated circuit used as a reference circuit.

13. The system according to Claim 4 wherein said slave integrated circuit is an integrated circuit identical in type to said master integrated circuit, said slave circuit to be bonded by said slave bonder.

14. The system according to Claim 4 wherein said analysis generator comprises:

a computerized relationship builder operable to select segments, images identifying said segments, and x-y locations of said bond pads and said images, and to express their mutual relationships in order to establish an interconnected network of said relationships; and

a file operable to store said interconnected network as said master bond program.

15. The system according to Claim 14 wherein said interconnected network is expressed in equations comprising x-y as well as polar coordinates.

16. The system according to Claim 4 further having a computerized slave regenerator comprising:

a bond points loader, coupled to said master file, operable to download stored master bond

points x-y locations data;

a segment identification loader, coupled to said master file, operable to download stored master segment x-y locations data;

a segment image locations loader, coupled to said bond points loader and said segment identification loader, operable to identify segment image x-y locations data;

a segment image loader, coupled to said segment identification loader and said segment image location loader, operable to identify segment images;

a second input data generator, operable to generate images of a plurality of bond segments of said slave circuit, defining the variable characteristics of said slave bonder;

a segment comparator, coupled to said segment image loader, said segment identification loader and said second input data generator, operable to retrieve said bond segment images from said three input sources, to compare and quantify said variable bonder characteristics, and to relocate bond segments;

a bond location corrector, associated with said slave bonder and coupled to said segment comparator, operable to retrieve said relocated bond segments and to re-compute said bond locations in each of said segments;

a slave circuit image generator;

an alignment reference image collector, coupled to said slave circuit image generator, operable to generate images of alignment references on said

slave circuit; and

a relationship generator, coupled to said bond location corrector and said alignment reference image collector, operable to construct relationships for said slave bonder between said re-computed bond locations, said alignment reference images and said reference image locations.

17. The system according to Claim 4 further having a computerized slave corrector comprising:

an alignment reference comparator, coupled to said alignment reference image collector within said third input data generator and further to said fourth input data generator, operable to compare said alignment reference image provided by said regenerator with the alignment image input from said slave circuit on said slave bonder, and to quantify shifts, rotations, and scalings between said two images or image parts;

a correcting re-computer, coupled to said alignment reference comparator, to said bond location corrector within said adaptive compensator, and to said relationship generator, operable to recompute the bond pad locations on said slave circuit based on the recreated bond x-y locations and the rebuilt relationships between said x-y locations and the alignment reference image locations, and thus to correct the slave bond program; and

a computerized bonder, coupled to said bond program corrector, operable as said slave bonder to attach connecting bonds onto the bond pads of

said slave circuit directed by said re-computed bond program.

18. A computer-implemented method for customizing the operational program for a slave object on a slave machine, comprising the steps of:

grouping the action sites of a master object on a master machine into segments and storing the reference data related to said segments in a master file;

regenerating said master reference data so that variable characteristics of said slave machine are defined and adaptively compensated; and

correcting said operational program for said slave object on said adaptively compensated slave machine.

19. A computer-implemented method for compensating slave machine variability and customizing operational programs for working on action sites of slave objects, comprising the steps of:

generating input data associated with a master machine, said data collected from a master object, related in geometry or history to said slave object, and comprising geometrical information of action sites and action segments, images of said segments, and geometrical information of said images;

generating an analysis for constructing relationships for said master machine between said action site locations, action segments, and segment image locations;

storing said relationships, said geometrical information and said images in a master file as an

operational master program;

generating input data associated with said slave machine, said data collected from said slave object and comprising images of a plurality of action segments, defining the variable characteristics of said slave machine;

retrieving said action segment images from said master operational program as well as from said slave machine, comparing and quantifying said variable machine characteristics, and relocating said action segments;

retrieving said relocated action segments and re-computing said action locations in each of said segments;

generating input information comprising images of alignment references collected from an object selected first from said slave objects;

constructing relationships for said slave machine between said re-computed action locations, said alignment reference images, and said reference image locations;

generating input information comprising images of alignment references collected from an object selected consecutively from said slave objects;

comparing said alignment reference images from said first selected slave object with said alignment reference images from said consecutively selected slave object; and

correcting any deviations found between said reference images, combining the result with said relationships, re-computing said action x-y locations, and correcting said operational program

of said slave machine for working on said action sites of said consecutively selected slave object.

20. A computer-implemented method for customizing the bond program for a slave circuit on a slave bonder, comprising the steps of:

grouping the bond pads of a master circuit on a master bonder into segments and storing the reference data related to said segments in a master file;

regenerating said master reference data so that variable characteristics of said slave bonder are defined and adaptively compensated; and

correcting said bond program for said slave circuit an said adaptively compensated slave bonder.

21. A computer-implemented method for compensating slave bonder variability and customizing bond programs for attaching connecting bonds onto bond pads of a slave integrated circuit, comprising the steps of:

generating input data associated with a master bonder, said data collected from a master integrated circuit, related in geometry to said slave integrated circuit, and comprising geometrical information of bond pads and bond pad segments, images of said segments, and geometrical information of said images;

generating an analysis for constructing relationships for said master bonder between said bond pad locations, bond segments, and segment image locations;

storing said relationships, said geometrical information and said images in a master file as a master bond program;

generating input data associated with said slave bonder, said data collected from said salve circuit and comprising images of a plurality of bond segments, defining the variable characteristics of said slave bonder;

retrieving said bond segment images from said master bond program as well as from said slave bonder;

comparing and quantifying said variable bonder characteristics, and relocating said bond segments;

retrieving said relocated bond segments and re-computing said bond locations in each of said segments;

generating input information, comprising images of alignment references collected from a circuit selected first from said slave circuits;

constructing relationships for said slave bonder between said re-computed bond locations, said alignment reference images, and said reference image locations;

generating input information, comprising images of alignment references collected from a circuit selected consecutively from said slave circuits;

comparing said alignment reference images from said first selected slave circuit with said alignment reference images from said consecutively selected slave circuit; and

correcting any deviations found between said reference images, combining the result with said relationships between bond locations and alignment reference image locations, and re-computing said bond pad x-y locations; and

correcting said bond program of said slave bonder for attaching bonds onto said bond pads of said consecutively selected slave circuit.

22. The computer-implemented method according to Claim 21 wherein said step of generating input data from said master circuit comprises:

selecting bond pad points, collecting x-y locations correlated to said points, and storing said x-y locations data in a reference x-y file;

grouping said bond pads into segments, determining which bond points belong to which of said segments, and storing said segments data in a bond pad segments file;

selecting x-y locations and geometrical information identifying segment images and storing said image x-y locations data in a segment image x-y locations file; and

collecting images of said segments and storing said images in a segment image file.

23. The computer-implemented method according to Claim 21 wherein said step of generating an analysis for constructing relationships comprises:

selecting x-y locations of said bond pads;

expressing the mutual geometries of said x-y locations;

expressing the relations of said x-y locations to said bond pad segments and segment identifying images and image locations;

establishing the interconnected network between said geometries and relations comprising equations expressed in x-y as well as polar coordinates; and

storing said network, said geometries and said images in a file as the master bond program.

24. The computer-implemented method according to Claim 21 wherein said step of retrieving from said master file comprises the steps of:

downloading said stored bond pad x-y locations data;

downloading said stored segment x-y locations data; and

combining said downloaded data into a segment-identifying images x-y locations loader, as well as a segment-identifying images loader.

25. The method according to Claim 21 wherein said step of generating input information comprises the steps of:

selecting a first circuit from the plurality of slave circuits, the bond pads of said circuit to be bonded by said slave bonder;

selecting images of bond segments of said first slave circuit, defining the variable characteristics of said slave bonder; and

storing said images in a bond segment input file.

26. The computer-implemented method according to Claim 21 wherein said step of comparing comprises the steps of:

retrieving said bond segment images from said loaders, supplied by said master file, and from said input file; and

comparing said stored segment images;

quantifying shifts, rotations and scalings between said two segment images to quantify said variable bonder characteristics; and

relocating said bond segments.

27. The computer-implemented method according to Claim 21 wherein said step of correcting comprises the steps of:

retrieving said relocated bond segments;

re-computing the x-y locations of said bond pads in each of said segments; and

correcting said variable bonder characteristics by compensating for apparatus-dependent variability as well as adapting to time-dependent variability.